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Strange quasiparticles in 1D Peierls systems: normal state properties and metal-insulator transitions

M. Grioni[1], L. Perfetti[1], G. Margaritondo[1], J. Voit[2], H. Hoechst[3]

[1] *Institut de Physique Appliquée, Ecole Polytechnique Fédérale (EPFL), CH-1015 Lausanne, Switzerland*

[2] *Theoretische Physik 1, Universität Bayreuth, D-95440 Bayreuth, Germany*

[3] *Synchrotron Radiation Center, University of Wisconsin-Madison, Stoughton, WI 53589-3097, USA*

Quasi-one dimensional (1D) conductors are ideal model systems to investigate the influence of translational invariance, correlations, and long-range order on the electronic states. We used high-resolution ARPES to study three typical 1D Peierls compounds: $(TaSe_4)_2I$, $(NbSe_4)_3I$ and $K_{0.3}MoO_3$. In the normal metallic phases, the dispersing spectral features and shadow bands reflect the competing periodicities of the lattice and fluctuating charge-density-wave (CDW) potentials [1]. The energy- and momentum-dependent lineshapes indicate that the quasiparticles are strongly renormalized by the electron-phonon interactions, and confined over few (3-4) atomic distances. The condensation of these polaronic carriers at the CDW transition, and the progressive opening of the Peierls gap, are manifest in the temperature-dependent spectra. The spectral leading edge, rather than the peak energy, identifies the gap energy scale, in stark contrast with a conventional weak-coupling scenario.

[1] J. Voit *et al.*, Science **290**, 501 (2000).